

腹腔镜肝左外叶供肝获取术中供肝血管影像学解剖特征及其临床意义

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【摘要】 目的 探讨腹腔镜肝左外叶供肝获取术中供肝血管的影像学解剖特征及临床意义。**方法** 采用回顾性描述性研究方法。收集 2016 年 10 月至 2018 年 12 月复旦大学附属华山医院收治的 39 例活体肝移植供者的临床资料;男 10 例,女 29 例;年龄为 (31 ± 7) 岁。同时收集 39 例活体肝移植受者的临床资料;男 26 例,女 13 例;年龄为 8 个月(4~68 个月)。供者术前常规行腹部增强 X 线计算机体层摄影术检查、三维血管重建判断供肝血管解剖情况。供者均施行腹腔镜肝左外叶供肝获取术。观察指标:(1)术前影像学检查三维血管重建情况。(2)手术情况。(3)随访情况。采用门诊方式对受者进行随访,了解受者肝移植后并发症情况。随访时间截至 2019 年 10 月。正态分布的计量资料以 $\bar{x} \pm s$ 表示,组间比较采用 t 检验。偏态分布的计量资料以 M (范围)表示。计数资料以绝对数或百分比表示。**结果** (1)术前影像学检查三维血管重建情况。39 例供者术前影像学检查三维血管重建显示肝动脉和肝静脉解剖学特征包括:①肝动脉情况为 11 例供者存在肝中动脉,其中 5 例起始于肝右动脉,3 例起始于肝右动脉和肝左动脉汇合处,3 例起始于肝左动脉。2 例供者肝左动脉解剖变异,均存在副肝左动脉,起始于胃左动脉。26 例供者无肝中动脉,肝左动脉无解剖变异。②肝静脉情况:9 例供者肝左静脉和肝中静脉分别汇入下腔静脉。7 例供者存在肝左静脉左上缘支。23 例供者肝左静脉与肝中静脉共干汇入下腔静脉。(2)手术情况。①39 例供者均成功施行腹腔镜肝左外叶供肝获取术,手术时间为 (160 ± 32) min,术中出血量为 (142 ± 74) mL。②11 例有肝中动脉供者中,8 例为肝左动脉优势型,留取肝左动脉用于肝移植术中肝动脉吻合重建,3 例肝中动脉起始于肝左动脉,留取肝左动脉和肝中动脉共干用于肝移植术中肝动脉吻合重建。2 例肝左动脉解剖变异供者中,1 例为副肝左动脉优势型,1 例为肝左动脉优势型,分别留取副肝左动脉和肝左动脉用于肝移植术中肝动脉吻合重建。其余 26 例供者留取肝左动脉用于肝移植术中肝动脉吻合重建。③39 例供者中,11 例术中行肝左静脉优先入路,28 例术中行非肝左静脉优先入路。肝左静脉优先入路供者手术时间和术中出血量分别为 (147 ± 22) min 和 (110 ± 44) mL,非肝左静脉优先入路供者上述指标分别为 (169 ± 33) min 和 (154 ± 81) mL,两者上述指标比较,差异均有统计学意义($t=4.19, 2.81, P<0.05$)。(3)随访情况。39 例受者均获得术后 10 个月的随访,随访期间未出现肝动脉吻合口出血、狭窄,以及由肝动脉供血不良引起的缺血性胆管损伤和胆道狭窄等并发症,也未出现肝静脉流出道狭窄相关并发症。**结论** 腹腔镜肝左外叶供肝获取术前影像学检查三维血管重建可发现肝中动脉和肝左动脉解剖变异,指导手术入路的选择。腹腔镜肝左外叶供肝获取术对于符合条件的供者推荐采用肝左静脉优先入路,可缩短手术时间、减少术中出血量。

【关键词】 胆道疾病; 肝脏疾病; 供肝获取; 活体肝移植; 腹腔镜检查

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Imaging anatomical features of donor liver blood vessels in laparoscopic left lateral donor liver acquisition and clinical significance

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【Abstract】 Objective To investigate the imaging anatomical features of donor liver blood vessels in laparoscopic left lateral donor liver acquisition and their clinical significance. **Methods** The retrospective and descriptive study was conducted. The clinical data of 39 living donor liver transplantation (LDLT) donors who were admitted to Huashan Hospital Affiliated to Fudan University between October 2016 and December 2018 were collected. There were 10 males and 29 females, aged (31 ± 7) years. The clinical data of 39 LDLT recipients were

collected. There were 26 males and 13 females, aged 8 months (range, 4–68 months). Abdominal enhanced computed tomography and three-dimensional vascular reconstruction were performed on donors to evaluate the anatomical characteristics of hepatic vessels. All the donors underwent laparoscopic left lateral donor liver acquisition. Observation indicators: (1) three-dimensional vascular reconstruction of preoperative imaging; (2) surgical conditions; (3) follow-up. Follow-up was performed using outpatient examination to detect complications of recipients after LDLT up to October 2019. Measurement data with normal distribution were expressed as $Mean \pm SD$, and comparison between groups was analyzed by the t test. Measurement data with skewed distribution were represented as M (range). Count data were expressed as absolute numbers or percentages. **Results** (1) Three-dimensional vascular reconstruction of preoperative imaging: the anatomical characteristics of hepatic artery and hepatic vein revealed by three-dimensional vascular reconstruction of preoperative imaging of 39 donors included ① middle hepatic artery was present in 11 donors, among which 5 started from the right hepatic artery, 3 from the confluence of the right and left hepatic artery, and 3 from the left hepatic artery. Two donors had anatomical variation in the left hepatic artery which was presentation of left accessory hepatic artery originated from the left gastric artery. The other 26 donors had no middle hepatic artery or anatomical variation in the left hepatic artery. ② The left hepatic vein and the middle hepatic vein of 9 donors were respectively drained into the inferior vena cava. Seven donors had the left upper branch of the left hepatic vein, and 23 donors had a joint trunk of the left hepatic vein and the middle hepatic vein which drained into the inferior vena cava. (2) Surgical conditions: ① all the 39 donors successfully underwent laparoscopic left lateral donor liver acquisition. The operation time and volume of intraoperative blood loss were (160 ± 32) minutes and (142 ± 74) mL. ② Of 11 donors with middle hepatic artery, left hepatic artery was the dominant artery in 8 donors and was used for hepatic artery anastomosis and reconstruction in liver transplantation, middle hepatic artery started from left hepatic artery in 3 donors and the joint trunk of left and middle hepatic artery was used for hepatic artery anastomosis and reconstruction in liver transplantation. Of 2 donors with anatomical variation in the left hepatic artery, one had left accessory hepatic artery as the dominant artery and the other had left hepatic artery as the dominant artery. Left accessory hepatic artery and left hepatic artery were respectively used for hepatic artery anastomosis and reconstruction in liver transplantation. The other 26 donors had left hepatic artery for hepatic artery anastomosis and reconstruction in liver transplantation. ③ Among the 39 donors, 11 received intraoperative left hepatic vein preferred approach and 28 received intraoperative non-left hepatic vein preferred approach. The operation time and volume of intraoperative blood loss of donors with left hepatic vein preferred approach were (147 ± 22) minutes and (110 ± 44) mL, respectively, versus (169 ± 33) minutes and (154 ± 81) mL of donors with non-left hepatic vein preferred approach, showing significant differences in the above indicators between the two groups ($t = 4.19, 2.81, P < 0.05$). (3) Follow-up: 39 donors were followed up for 10 months. During the follow-up, there was no hepatic artery anastomotic bleeding, stenosis, ischemic bile duct injury and biliary stenosis caused by poor hepatic arterial blood supply, or any complications related to hepatic venous outflow tract stenosis. **Conclusions** Three-dimensional vascular reconstruction before laparoscopic left lateral donor liver acquisition can reveal the anatomical variation of middle hepatic artery and left hepatic artery, which can guide the selection of surgical approach. The left hepatic vein preferred approach is recommended for the qualified donor in the laparoscopic left lateral donor liver acquisition, which can shorten the operation time and reduce the volume of intraoperative blood loss.

【Key words】 Bile duct diseases; Hepatic diseases; Donor liver acquisition; Living donor liver transplantation; Laparoscopy

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活体肝移植是儿童终末期肝病的主要手术方式,成人肝左外叶供肝即可满足体质量较小的患儿需求^[1]。该手术方式在我国各大移植中心已经广泛开展。随着腹腔镜肝切除术的日益进步,大部分肝脏手术可在腹腔镜下完成,腹腔镜肝左外叶切除术已成为肝左外叶切除的首选方法^[2-6]。腹腔镜肝左外叶供肝获取术也逐渐被外科医师认可^[7-11]。肝脏血供丰富,其血管变异常见^[12-14]。因肝左动脉、门静脉左支和肝左静脉存在不同的解剖变异,需采取不同手术方式获取供肝。本研究回顾性分析 2016 年 10 月至 2018 年 12 月我科收治的 39 例活体肝移植供者和 39 例受者的临床资料,探讨腹

腔镜肝左外叶供肝获取术中供肝血管影像学解剖特征及其临床意义。

1 资料与方法

1.1 一般资料

采用回顾性描述性研究方法。收集 39 例活体肝移植供者的临床资料;男 10 例,女 29 例;年龄为 (31 ± 7) 岁, BMI 为 (22 ± 3) kg/m²。同时收集 39 例活体肝移植受者的临床资料;男 26 例,女 13 例;年龄为 8 个月(4~68 个月);39 例受者中,20 例为先天性胆道闭锁,19 例为其他肝脏疾病和胆道疾病。供者均为患儿直系亲属,自愿无偿捐献供肝。本研

究符合《赫尔辛基宣言》的要求。活体供者、受者家属均签署知情同意书。

1.2 纳入标准和排除标准

纳入标准:(1)供者心、肺、肝、肾等全身重要脏器无器质性疾病并且功能良好;无重大传染病;无肝炎、肝硬化、脂肪肝等病史;肝脏主要血管和胆管形态结构正常;肝脏储备功能良好。(2)受者:胆道梗阻淤胆引起的肝功能异常和终末期肝病等肝移植适应证患儿。

排除标准:(1)供者肝脏血管或胆管严重变异不适合行腹腔镜肝左外叶供肝获取术。(2)受者为肝移植禁忌证患儿。

1.3 术前影像学检查

供者术前常规行腹部增强 CT 检查、三维血管重建(EDDA 公司 IQQA[®]三维肝脏成像系统)判断供肝血管解剖情况。

1.4 手术方法

供者取平卧“大”字位,脐下取 1 cm 切口建立气腹并作为观察孔,在左右两侧各放置两个穿刺器围绕肝脏呈扇形分布作为操作孔。手术流程:(1)解剖第一肝门,在肝外分离肝左动脉和门静脉左支,分离肝左动脉时需要显露肝右动脉和肝中动脉,术前影像学检查显示存在源自胃左动脉的副肝左动脉时,打开肝、胃韧带将副肝左动脉和胃左动脉解剖并裸化,留至最后切断。(2)离断肝周韧带,游离肝左外叶。(3)将肝左外叶向右侧翻起,解剖第二肝门,术前影像学检查显示肝左静脉和肝中静脉分别汇入下腔静脉或两者共干<1 cm,或存在肝左静脉左上缘支时,需在肝外预先分离肝左静脉或其左上缘支;对于有多支肝左静脉或肝左静脉和肝中静脉共干较长时,则离断肝实质后在肝内离断肝左静脉。(4)按照预切线离断肝实质,在肝门水平离断左肝管。(5)运用导尿管对剩余肝组织进行牵拉悬吊,沿悬吊指引平面离断剩余肝组织。(6)全身肝素化后依次夹闭并离断肝左动脉、门静脉左支和肝左静脉。(7)将移植物装入标本袋后从腹部横行切口取出。手术入路选择:(1)肝左静脉优先入路为术前影像学检查三维重建显示肝左静脉和肝中静脉分别汇入下腔静脉,术中解剖第二肝门后,可在肝外分离肝左静脉;存在肝左静脉左上缘支,术中解剖第二肝门后,可在肝外分离肝左静脉左上缘支。(2)非肝左静脉优先入路:肝左静脉与肝中静脉共干较长,肝左静脉无法在肝外解剖分离,需在肝内处理并离断。

1.5 观察指标

(1)术前影像学检查三维血管重建情况:供者肝动脉和肝静脉情况。(2)手术情况:①供者手术方式、手术时间、术中出血量。②供肝优势肝动脉及其留取用于肝移植术中肝动脉吻合重建情况。③手术入路情况,肝左静脉优先入路和非肝左静脉优先入路供者手术时间和术中出血量。(3)随访情况:获得随访的受者例数、随访时间、随访期间并发症情况。

1.6 随访

采用门诊方式对受者进行随访,了解受者肝移植后并发症情况。随访时间截至 2019 年 10 月。

1.7 统计学分析

应用 SPSS 18.0 统计软件进行分析,正态分布的计量资料以 $\bar{x} \pm s$ 表示,组间比较采用 t 检验。偏态分布的计量资料以 M (范围)表示。计数资料以绝对数或百分比表示。 $P < 0.05$ 为差异有统计学意义。

2 结果

2.1 术前影像学检查三维血管重建情况

39 例供者术前影像学检查三维血管重建显示肝动脉和肝静脉的解剖学特征包括:(1)肝动脉情况为 11 例供者存在肝中动脉,其中 5 例起始于肝右动脉(图 1A),3 例起始于肝右动脉和肝左动脉汇合处(图 1B),3 例起始于肝左动脉(图 1C)。2 例供者肝左动脉解剖变异,均存在副肝左动脉,起始于胃左动脉(图 1D)。26 例供者无肝中动脉,肝左动脉无解剖变异。(2)肝静脉情况:9 例供者肝左静脉和肝中静脉分别汇入下腔静脉(图 2A)。7 例供者存在肝左静脉左上缘支(图 2B)。23 例供者肝左静脉与肝中静脉共干汇入下腔静脉(图 2C)。

2.2 手术情况

39 例供者均成功施行腹腔镜肝左外叶供肝获取术,手术时间为 (160 ± 32) min,术中出血量为 (142 ± 74) mL。

11 例有肝中动脉供者中,8 例为肝左动脉优势型,留取肝左动脉用于肝移植术中肝动脉吻合重建,3 例肝中动脉起始于肝左动脉,留取肝左动脉和肝中动脉共干用于肝移植术中肝动脉吻合重建。2 例肝左动脉解剖变异供者中,1 例为副肝左动脉优势型,1 例为肝左动脉优势型,分别留取副肝左动脉和肝左动脉用于肝移植术中肝动脉吻合重建。其余 26 例供者留取肝左动脉用于肝移植术中肝动脉吻合重建。

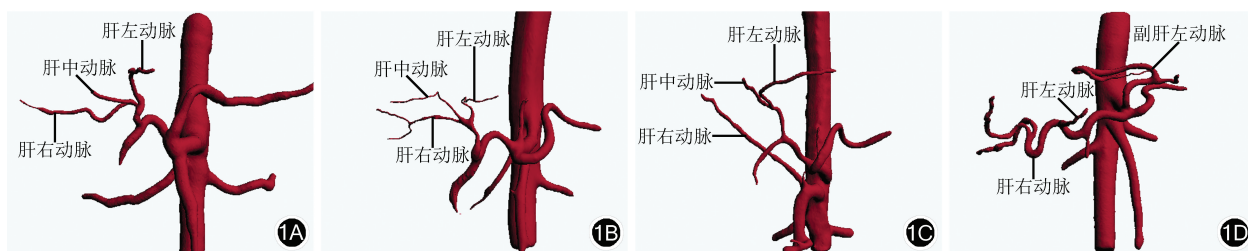


图1 供者肝脏动脉术前影像学检查三维重建情况 1A:肝中动脉起始于肝右动脉;1B:肝中动脉起始于肝左、右动脉分叉处;1C:肝中动脉起始于肝左动脉;1D:副肝左动脉起始于胃左动脉

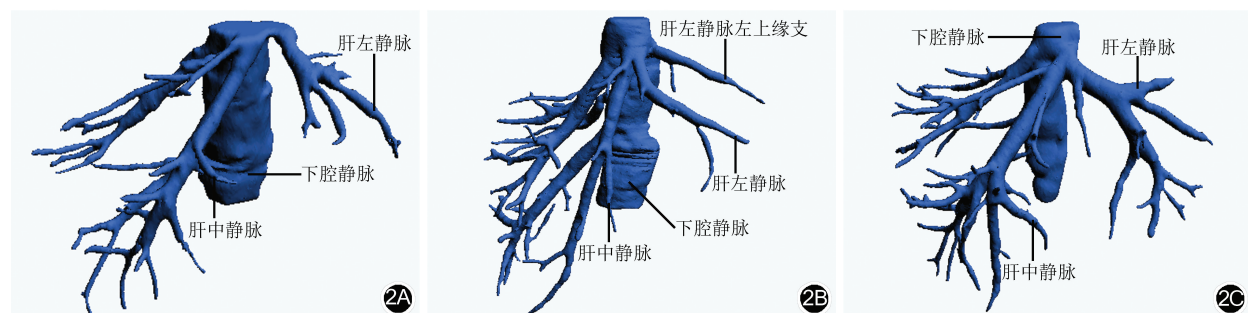


图2 供者肝脏静脉术前影像学检查三维重建情况 2A:肝左静脉直接汇入下腔静脉;2B:存在肝左静脉左上缘支;2C:肝左静脉和肝中静脉共干汇入下腔静脉

39 例供者中,11 例术中行肝左静脉优先入路,28 例术中行非肝左静脉优先入路。肝左静脉优先入路供者手术时间和术中出血量分别为 (147 ± 22) min 和 (110 ± 44) mL,非肝左静脉优先入路供者上述指标分别为 (169 ± 33) min 和 (154 ± 81) mL,两者上述指标比较,差异均有统计学意义($t=4.19, 2.81, P<0.05$)。

2.3 随访情况

39 例受者均获得术后 10 个月的随访,随访期间未出现肝动脉吻合口出血、狭窄,以及由肝动脉供血不良引起的缺血性胆管损伤和胆道狭窄等并发症,也未出现肝静脉流出道狭窄相关并发症。

3 讨论

腹腔镜肝左外叶供肝获取术具有解剖更精准、创伤更小等特点,随着腹腔镜肝切除术日臻成熟,部分肝移植中心开始开展该项手术^[15-20]。本研究腹腔镜肝左外叶供肝获取术手术时间低于国际报道的平均水平,术中出血量少于开腹肝左外叶供肝获取术^[8,11,17,21-22]。

供肝获取术与普通肝切除术的区别为:后者不用保留切除肝脏的功能和完整性;而供肝获取术需保证供肝的完整性和供肝管道的可使用性。对供肝门静脉、肝静脉、肝动脉和胆管的保护尤为重要,并且尽可能保留足够长的管道结构。这是腹腔镜供肝获取术的难点。因此,术前需详细评估肝脏血管,才

能制订合理的手术方式^[23-27]。

本研究采用术前影像学检查三维血管重建对供者肝脏血管进行详细评估,其结果显示:28.2%(11/39)供者存在肝中动脉,肝中动脉直径常与肝左动脉和肝右动脉比较,前者相对更细,较少表现为肝中动脉优势型。如肝中动脉起始于肝左动脉,应尽可能保留肝中动脉和肝左动脉共干;肝中动脉起始于肝右动脉或起始于肝左、右动脉汇合处,需评估肝中动脉和肝左动脉直径,选择直径较粗的优势动脉用于肝移植术中肝动脉吻合重建。本研究中同时存在肝中动脉和肝左动脉的供者均为肝左动脉优势型,肝移植术中舍弃肝中动脉,均选择肝左动脉用于肝移植术中肝动脉吻合重建。本研究中 2 例(5.1%)供者存在副肝左动脉,均由胃左动脉发出。这低于文献报道的副肝左动脉发生率^[28]。本研究存在副肝左动脉供者,供肝获取术中需要同时分离副肝左动脉和肝左动脉,并比较两者直径,选择直径较粗的优势动脉用于肝移植术中肝动脉吻合重建。供肝获取术中牵拉肝动脉时需轻柔,防止肝动脉内膜破坏以及夹层形成。供肝获取术中常规不进行第一肝门阻断,以防止血管内膜损伤和肝脏缺血再灌注损伤。肝移植术后早期发生肝动脉血供不良将导致术后缺血性胆道并发症发生,影响受者的生存率^[29]。本研究随访期间,供者未发生因肝动脉血供不良导致的缺血性胆道并发症。这与供肝获取术中肝动脉的保

护和手术方案的正确选择相关。

部分研究者认为:肝切除术中预先分离肝静脉将引起难以控制的出血,因此,选择先离断肝实质后处理肝静脉^[30]。本研究术前运用影像学检查三维血管重建技术详细评估供肝情况,术中精细手术操作,对于肝左静脉直接汇入下腔静脉,或存在肝左静脉左上缘支情况,优先解剖第二肝门;对于肝左静脉与肝中静脉共干较长,不在肝外解剖第二肝门,离断肝实质后,在肝内离断肝左静脉。肝左静脉优先入路与非肝左静脉优先入路比较,前者手术时间明显缩短,术中出血量明显减少。解剖第二肝门在肝外分离肝左静脉需要花费时间,但优先解剖第二肝门后,离断肝实质时周围无重要管道,可缩短肝实质离断时间;还可减少因肝左静脉损伤止血时间,因此,总体手术时间缩短。肝左静脉优先入路还可避免因肝左静脉损伤引起的大出血和气体栓塞等严重并发症发生,且肝静脉损伤发生率降低,术中出血量明显减少^[31]。在肝外预先解剖肝左静脉与肝内离断比较,前者可保留更长的肝静脉,肝静脉整形率明显下降,为肝移植肝静脉吻合创造条件^[32]。

腹腔镜肝左外叶供肝获取术安全、可行,已逐渐被研究者接受^[33-37]。供者术前常规行影像学检查三维血管重建评估供肝血管解剖特征,拟订手术规划,术中仔细分离,保护变异血管,选择优势肝动脉用于肝移植术中肝动脉吻合重建。笔者建议:对于符合条件的供者,选择肝左静脉优先入路,在肝外分离肝左静脉及肝左静脉左上缘支,可减少术中出血量、缩短手术时间、保留更长的肝静脉主干。

综上,腹腔镜肝左外叶供肝获取术术前影像学检查三维血管重建可发现肝中动脉和肝左动脉解剖变异,指导手术入路的选择。腹腔镜肝左外叶供肝获取术采用肝左静脉优先入路可缩短手术时间、减少术中出血量。遵循术前详细评估、术中精细操作原则,可减少受者术后并发症发生。

利益冲突 所有作者均声明不存在利益冲突

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